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(56) Publications considered in evaluating patentability:  
European Patent 410,088 A2

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(54) Circuitry for a Welding Device

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(57) The invention concerns the circuitry for a welding device having a line voltage-powered rectifier 1, a capacitive intermediate circuit 2 to supply a current transformer 12 that is switched at the input end by semiconductor switches

3a, 3b and whose output end is connected to the welding process 13a, 13b via a network containing a rectifier diode 5, a smoothing reactor 7 and a free-wheeling diode 6, where the intermediate circuit voltage is stabilized by a voltage regulator 10, 11. To reduce the peak current load of the network due to the welding device, the setpoint generator 14 of voltage regulator 10, 11 has a forming circuit such that a sinusoidal current curve can be set at the input of the rectifier 1.

### Description

The invention concerns a circuit arrangement for a welding device with a line-voltage-powered rectifier, a capacitive intermediate circuit to supply a current transformer that is switched by semiconductor switches at the input end and whose output end is connected to the welding process via a network containing a rectifier diode, a smoothing reactor and a free-wheeling diode, where the intermediate circuit voltage is stabilized by a voltage regulator.

Such a welding device is known from European Patent Application 410,088. The switching of the current transformer at the input end is accomplished with this welding device by controllable electronic switches. With the known circuit, the voltage level in the intermediate voltage circuit is set at a predetermined setpoint by the fact that the actual value of the voltage of the intermediate circuit is detected by a voltage measuring device and stabilized at the intermediate circuit voltage level set at the setpoint input by the switching of a controllable switch installed between the rectifier output and the intermediate circuit.

With this circuit, tolerances in the network voltage level are compensated, so the semiconductor switches for controlling the current transformer at the input end need no longer be designed for the highest peak line voltage that can occur but instead they may be designed for the stabilized intermediate voltage level. The known circuit arrangement is suitable preferably for use of welding equipment on systems with a high load-bearing capacity because the capacitive intermediate circuit subjects the line system to loads with high current spikes. Therefore, if the line system is weak, the known circuit cannot be used without problems.

The object of this invention is therefore to improve on a welding device of the type defined initially such that it can be used without problems even on a weak network.

This object is achieved with a welding device of the type defined initially such that the setpoint generator of the voltage regulator has a forming circuit that makes it possible to set a

sinusoidal current curve at the input of the rectifier.

The forming circuit according to this invention achieves the result that the input current entering the rectifier has an almost sinusoidal curve, so current spikes are mostly prevented.

A welding device with the improved circuit arrangement according to this invention can be used to advantage at project sites where the available network is weak. This also makes it possible to use the welding equipment in the home workshop area (do-it-yourself market).

This invention is explained in greater detail below with reference to the figure, which shows a block schematic of one embodiment of the welding device according to this invention.

The block schematic shows a rectifier 1 powered by a single-phase a.c. voltage system, where input voltage  $U_i$  and input current  $I_i$  are supplied to the input of the rectifier. The output of rectifier 1 supplies power to a series connection of a smoothing reactor 8 and a rectifier diode 9, to which is in turn connected an intermediate circuit formed by capacitor 2. A controllable electronic switch 10 that is connected to the common terminal connection of the smoothing reactor 8 and rectifier diode 9 is part of a control circuit which receives the voltage at the output of rectifier 1 as a measured value, as illustrated in the figure. Upstream from control circuit 11 is a forming circuit 14 that sets a sinusoidal input current  $I_{ess,1}$  for the rectifier 1.

Intermediate circuit 2 supplies power to the input of a downstream current transformer 12, where the current transformer is driven by semiconductor switches 3a, 3b such that non-overlapping currents with alternating polarity are fed alternately into the primary winding of current transformer 12. In addition, free-wheeling diodes 4a, 4b are provided to demagnetize the current transformer during the intervals when the transformer is not being switched by the semiconductor switches 3a, 3b assigned to it.

The output end of the current transformer 12 is connected to a series circuit of another rectifier diode 5 and another smoothing reactor 7, which is in turn connected to the welding equipment 13a, 13b. Another free-wheeling diode 6 is provided at the

common terminal connection of another rectifier diode 5 and another smoothing reactor 7 to drain off the magnetic energy stored in the welding process and in the additional smoothing reactor 7.

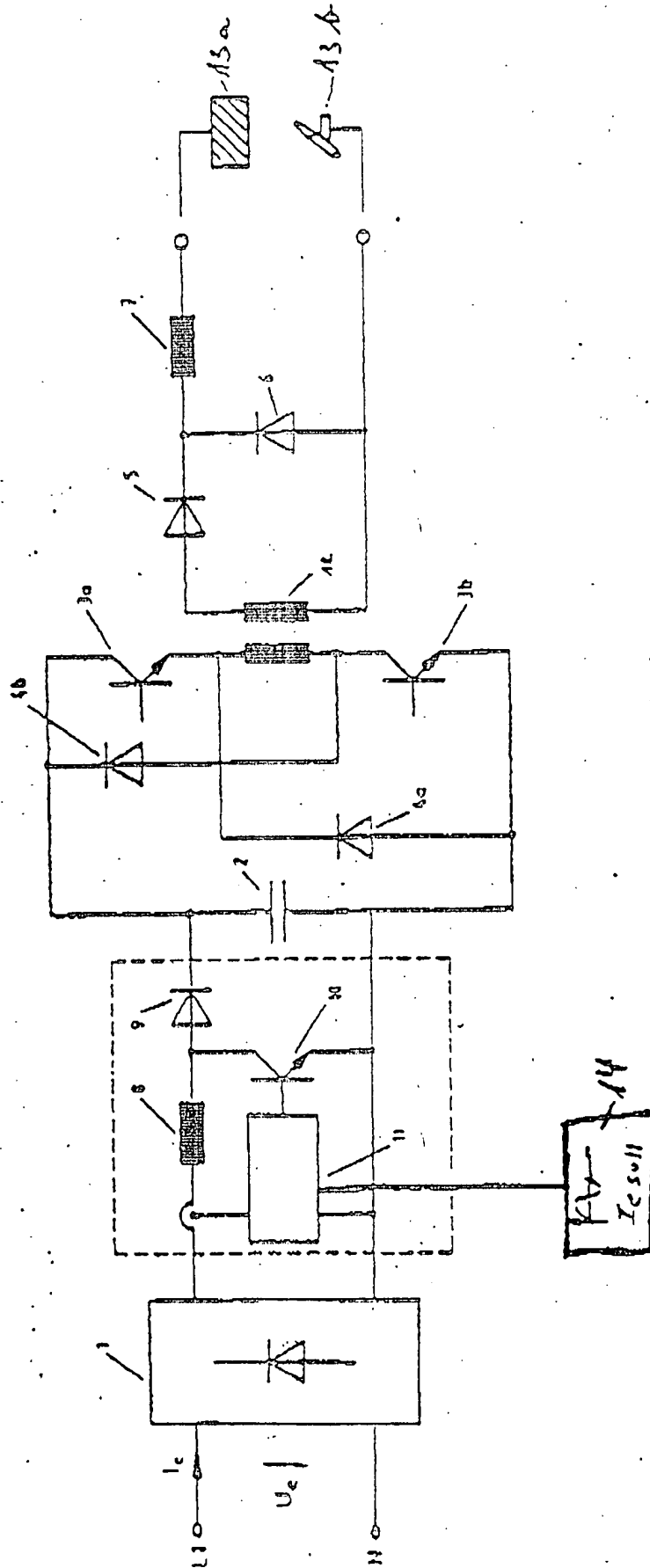
The control circuit according to this invention which is formed by the elements of the controlled semiconductor switches 10, the control unit 11 and the forming circuit 14 assures that the d.c. voltage applied to intermediate circuit capacitor 2 is stabilized. In addition, the forming circuit 14 in particular causes the switching of the controlled semiconductor switch 10 such that the input current  $I_1$  entering the rectifier 1 is almost sinusoidal. This greatly reduces the voltage peak burden on the system due to the welder because both the input current and the input voltage of the rectifier 1 are approximately sinusoidal.

## Patent Claim

Circuit arrangement for a welding device with a line-voltage-powered rectifier (1), a capacitive intermediate circuit (2) to supply power to a current transformer (12) which is switched at the input end by semiconductor switches (3a, 3b) and whose output is connected to the welding process (13a, 13b) via a network containing a rectifier diode (5), a smoothing reactor (7) and a free-wheeling diode (6), where the intermediate circuit voltage is stabilized by a voltage regulator (10, 11), characterized in that the setpoint generator (14) of the voltage regulator (10, 11) has a forming circuit such that a sinusoidal current characteristic can be set at the input of the rectifier (1).

Plus 1 page of drawings

$I_{eSet1}$  = input current setpoint  
 $u_e$  = input voltage



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